

REMARKS

By the present amendment, claim 1 is pending in the application.

Support For Claim Amendments

In claim 1, support for Ti, Nb, Ni, B and Ca in the amounts recited may be found in prior, now canceled, claim 2.

In the specification at page 6, lines 17-18, it is disclosed that Cu may be added. In the specification at page 6, lines 27-28 it is disclosed the Mo may be added. Thus, there is a disclosure that the steel of the present invention can be free from containing Cu and Mo.

The pickling limitation added at the end of amended claim 1 may be found in prior, now canceled, dependent claims 7 and 8. Dependent claim 7 disclosed the 7 to 15 mass % HCl concentration and dependent claim 8 disclosed the 0.5 to 5 mass % of HNO₃ concentration.

§103

Claims 1, 2, 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Pub. No. 2003/0111144 to Matsuoka et al.

This rejection, as applied to the amended claim 1, is respectfully traversed.

The Present Invention

A characteristic feature of the present invention is to provide a hot rolled steel sheet excellent in chemical convertibility free from bald spots based on the following discoveries.

1) Si concentration of less than 3.5% and Mn concentration of less than 3.5% in the surface oxides,

2) A specifically controlled steel sheet composition which does not contain Cu and Mo,

3) Surface roughness Ra of 3.0 μm or less,

4) Number of pittings of a diameter of 1 μm to 0.3 μm due to the pickling is an average 5 or less in squares of the steel sheet surface when dividing it into squares of 10 μm per side.

For these purposes, the pickling production conditions are strictly controlled and are:

5) dipping the steel sheet in an aqueous solution containing 0.5 to 5 mass % HNO_3 and 7 to 15 mass % HCl .

6) Fe ion concentration of 4 to 12%,

7) Immersing a hot rolled steel sheet in a solution temperature of 80 to 98°C for a time in the range of 40 sec or more, and

8) The HCl concentration (mass %) x dipping time (sec) becomes 520 or less.

These features are for the purpose of avoiding generation of bald spots caused by the increase of pitting during pickling (pitting defined in claim 1) and for avoiding generation of bald spots caused by remaining highly concentrated oxides (surface oxides limitations defined in claim 1).

Patentability

US 20003/0111144 (“US ‘144”)

The technology disclosed in US ‘144 relates to a hot and cold rolled steel plate and hot dip galvanized steel plate excellent in press-formability and strain aging hardening characteristics as typically represented by a ΔTS of 80 MPa or more. The steel plate of US ‘144 contains $\text{C} \leq 0.15$, $\text{Si} \leq 2.0\%$, $\text{Mn} \leq 3.0\%$, $\text{S} \leq 0.02\%$, $\text{N} \leq 0.02\%$, $\text{P} \leq 0.1\%$, $\text{Al} \leq 0.1\%$,

Cu: 0.5 - 3.0%, the balance Fe and unavoidable impurities, and has a structure having a ferrite phase as a main phase forming a composite structure with a secondary phase containing martensite phase in an area ratio of 2% or more.

Regarding the steel plate compositions, US '144 contains Cu: 0.5 - 3.0% as an indispensable element for reducing the difference in hardness between ferrite and martensite, and causing strain-induced precipitation of very fine carbides in martensite and converting the structure into a composite ferrite + martensite structure, as described in detail in [0234] - [0245] and [0268] of US '144. This means that the mechanical properties required in the US '144 only can be achieved by the addition of Cu (or Mo, Cr, W).

[0268] of US '144 discloses that Cu "is one of the most important elements in the invention." (Emphasis added).

On the other hand, the present invention does not contain Cu, and therefore is quite a different steel sheet or plate. Although the Office Action asserted that the steel sheet of US '144 has an overlapping composition, it is submitted that this position of the Office Action is completely overcome by amended claim 1.

Further, the US '144 does not disclose or suggest anything about what type of chemical conversion treatment is applied or how to apply this chemical conversion treatment. It is submitted that the treatment of US '144 does not belong to the type of acid pickling of the hot rolled steel plate because US '144 discloses that this treatment must be carried out after annealing or galvanizing. Regarding this treatment, US '144 discloses that this treatment is a quite different step from the present treatment. Further, US '144 discloses at [0313] that "On the surface of the steel sheet preheated on the continuous annealing line, P in the steel is concentrated, and oxides of Si, Mn and Cr are concentrated, forming a surface concentration layer. It is favorable for improving platability to remove this surface

concentration layer through pickling and to conduct annealing in a reducing atmosphere subsequently on the continuous hot-dip galvanizing line.”

This statement does not mean pickling of the hot rolled steel sheet according to the present invention.

US ‘144 does not disclose the specific pickling carried out by the present invention to provide the claimed pitting distribution or the claimed limitations on oxides on the surface of the steel sheet. US ‘144 does not disclose or suggest the claimed pitting distribution or the claimed limitations on the oxides on the steel sheet surface.

As previously discussed, a conventional pickling method is described in Attachment 1 “Handbook of Iron & Steel” (Published Japan Iron & Steel Association, May 15, 1980). On page 508, a loss by pickling in the case of hydrochloric acid pickling is small in the area at the HCl concentration of 12 - 18%, temperature of 20 - 47°C and solubility rate of FeO is large compared with sulfuric acid. In Table 12 on page 508, various data are shown.

It is understood that the above mentioned condition is a normal or conventional pickling condition.

According to the present invention, the pickling condition is that : HCl concentration of 7 - 15%, Fe ion concentration of 4 - 12%, temperature of 80 - 98°C for more than 40 seconds, HCl concentration x immersion time of 520 or less. Although the HCl concentration overlaps partly, the range of Fe ion concentration and temperature are different in the present invention. Therefore, according to the present invention, pickling is carried out at the conditions in the area of low HCl concentration and high temperature without saturation of ferric chloride. On the other hand, conventional pickling is carried out at the

conditions in the area of low temperature and high HCL concentration. Therefore, the present inventive pickling condition is quite different from the conventional one.

As mentioned above, US '144 does not disclose or suggest the pickling of the present invention which is required to obtain the hot rolled steel sheet excellent in chemical convertibility free from bald spots and which has the surface roughness, pitting and limitations on oxides on the surface of the steel sheet as defined in the amended independent claim 1.

US '144 does not disclose or suggest the method of the present invention. US '144 does not disclose or suggest the surface roughness, pittings or limitations on the oxides on the steel sheet surface of claim 1. US '144 does not disclose or suggest a method to obtain the surface roughness, pittings or limitations on the oxides on the steel sheet surface defined in claim 1.

It is therefore submitted that amended independent claim 1 is patentable over US 2003/0111144.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed to issue.

Respectfully submitted,

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